Space Weather Technical Forecast

Issued on Saturday, 14 October 2023 at 01:13 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Current fast wind from CH58/- gradually reducing into the UTC weekend. Rising Chance of M-class flares. Fast wind from CH60/+ likely to arrive early next week, with a Chance of G1/Minor Storm.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low in the past 24 hours, with only background C-class flares. There are currently up to six sunspots on the visible disc. There has been some minor growth in AR3464, AR3465 and AR3466, but generally all spots appear to be simple east-west dipoles. No Earth-directed CMEs have been observed in the past 24 hours.

Solar Wind / Geomagnetic Activity: Solar winds, as measured by DSCOVR at L1 started in a slow regime but showed a very marked progression into a CIR from around 13/0300UTC. This is most likely to be the substantially delayed fast wind emanating from trans-equatorial CH58/-. The solar wind speed rose from 300 to 510km/s in the period, with much of this occurring after 13/0300UTC. The associated solar wind density change was more marked still, rising from single-figures ppcc to the low-thirties with the CIR. The IMF showed a similarly increasing magnitude signal, rising from a stable Background to peak at 24nT after 13/0800UTC, although the all important north-south component was almost purely co-aligned with Earth's magnetic field, meaning the +22nT peak was not matched by an anti-aligned value, which only reached -9nT. The phi angle was mainly negative (towards the Sun), but showed occasional deflections into positive territory. The net effect of the above solar wind measures was initially Quiet geomagnetic activity, but rising to Unsettled in the current UTC morning, with a provisional Kp3 in the 06-09UTC interval.

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux was at Background levels.

GOES16 high energy (greater than 2MeV) electron flux was at Normal Background to Moderate levels, peaking around 190pfu at 13/1355UTC. Associated 24-hour fluence was well below the Active (1e8 integrated pfu) threshold. The observation at 14/0001UTC was 2.17e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: There is a slightly rising Chance of M-class flares through the four-day period as a result of eastern limb arrivals into the UTC weekend.

Solar Wind / Geomagnetic Activity: No CMEs feature in the current forecast.

The current fast wind from CH58 is likely to wane into the UTC weekend, although there remains a chance of Active intervals early on Day 1 (14 Oct), with a tentatively Slight Chance of a G1/minor storm interval, if the Bz becomes negative for a prolonged period. Becoming mainly Quiet again as the UTC weekend progresses. By the new working week CH60/+ fast wind may

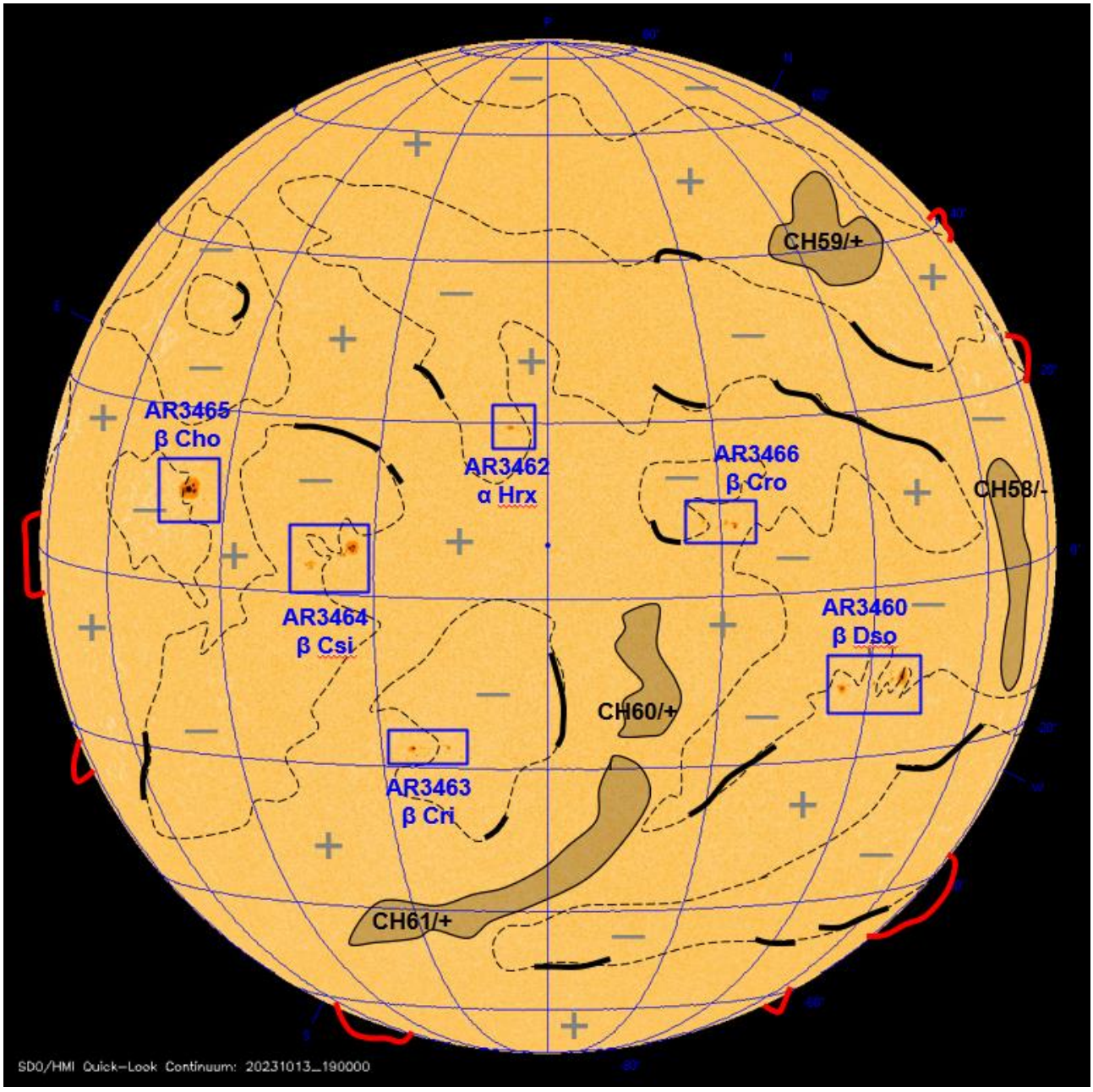
Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

arrive (16 Oct), again leading to a Chance chance of G1/Minor Storm.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux will most likely remain at Background levels. The high energy electron flux (greater than 2MeV) forecast is expected to be at background to moderate levels on day 1 (14 Oct), with a slight chance of reaching the Active threshold from day 2 (15 Oct) as the effects of the fast wind from CH58 wane.

Figure 1. Solar Analysis Valid 14/1900 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

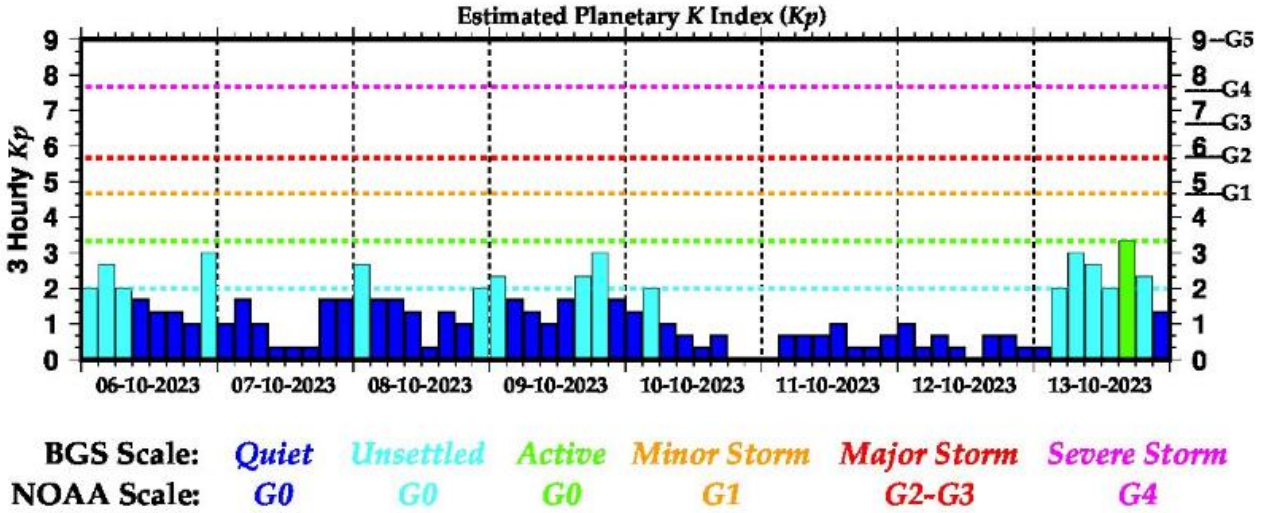
Geomagnetic Storms:

No CMEs feature in the forecast.

Earth is currently in the overdue arrival of a fast solar wind from CH58/-, with speeds currently at Elevated levels, above 500km/s. As a result the Slight Chance of a G1/Minor Storm has been restored in the current UTC day, waning during the UTC weekend. A lull in activity should follow on Day 2 (15 Oct) ahead of the next fast wind from CH60/+, which is due to arrive on Day 3 (16 Oct), with speeds potentially reaching 550-600km/s (based on persistence), with a further Chance of G1/Minor Storm, before activity begins to gradually wane on Day 4 (17 Oct). Because of the time of year, this second fast wind from CH60/+ may prove to represent the peak of activity for the four days as a whole.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	1	30	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: BGS Estimated Planetary K Index (Kp).



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

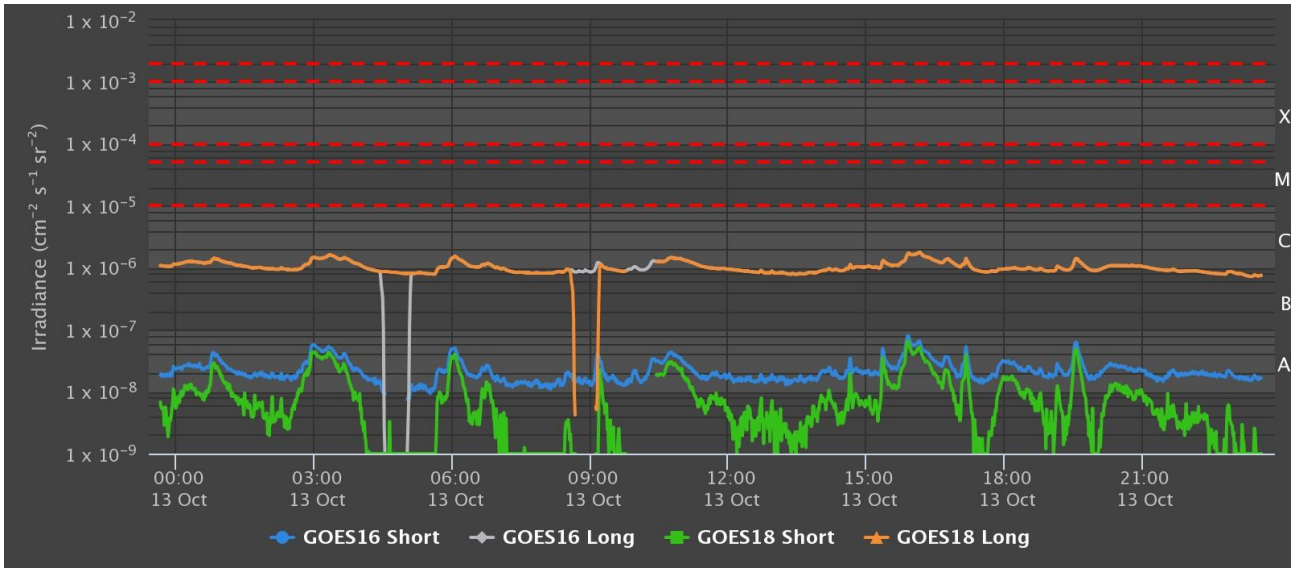
© Crown Copyright 2023. All Rights Reserved.

Radio Blackouts - X-Ray Flares:
NSO GONG imagery loops of current sunspots imply a generally simplifying trend, with this also inferred from the quietening X-ray trace at GOES 16 and 18, and the Penticton 10.7cm flux drop from 166sfu on 10 October to the most recent observation of 149. This will have been helped by the departure of the recently active Ex-AR3451 over the northwestern solar horizon.

Given the quiescent front side of the disc at present, it is difficult to envisage that the arrival of any new regions in the east will not increase activity, especially since the north-eastern limb has produced some recent CME activity, and EUV flux loops are clearly visible here. All considered, there is a slightly rising Chance of M-class flares in the forecast period.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	40	40	40
Very Active	R3 to R5 X Class	No	1	5	5	5

Figure 3: GOES X-Ray flares.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

Solar Radiation Storms - (High Energy Protons):

The high energy (greater than 10MeV) proton flux observed by GOES16 is most likely to persist at Background levels. There remains a Slight Chance of S1/Minor Solar Radiation Storms throughout the period, should any suitable larger flares occur.

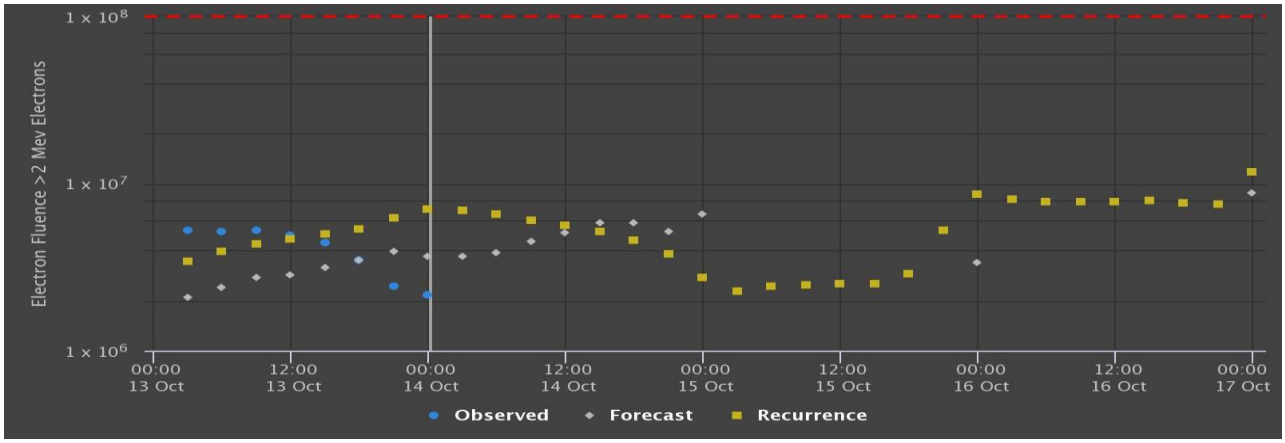
Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	5	5	5	5
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The high energy electron forecast is now of lowered confidence given the belated arrival solar fast wind from CH58/-. Initial Normal Background to Moderate diurnal variation is likely to show some attenuation at first, probably rebounding at GEO later in the UTC weekend, with perhaps a restored Chance of surpassing Active should the fast wind be emitted nearer the expected 600km/s rather than the purely radial assumption of 450-500km/s. The very end of the four day period should again see reducing counts at GEO in terms of electrons, however the exceedance risk still applies for earlier in that UTC day.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ 2 MeV ≥ $1x10^8$	No	5	30	30	10
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 4: REFM electron fluence



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.